



ISSD

NEWSLETTER

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Note From the Editor:



There is nothing new under the sun! Those oft quoted words of Solomon were, until recently, true. Has there ever been an international society dedicated to the study of Dendrobatid frogs? Well now there is; something truly NEW (under the sun). As a member of ISSD you have been witness to an historic event. Maybe that is a little overstated, but it is good to know that this new thing is doing well.

This edition of the ISSD Newsletter marks the last installment of Volume I. That is somewhat of an historic event from my perspective. I have put a great deal of effort into this volume and on the occasion of the publication of the last edition I would like to take this opportunity to thank all those members who have made it work, especially those who have submitted papers for publication. Also I would like to thank in advance, all those who will help to make Volume II as much of a success.

There will be some changes coming up this next year. We hope to begin publishing photographs. You may submit black and white prints (or better yet, half-tones of your prints) along with the text drafts. Having the half tones already made will save me a great deal of work. If you do not know what a half-tone is, ask the advice of your local printer. Another change that you will be seeing concerns the "featured frog" format. Although this idea had some benefits and was generally well received, it did create some problems with printing deadlines and I think it may have

inhibited some people from submitting papers. Therefore we are dropping it. Anyone may submit any paper, on any subject, at any time they wish. We hope to develop a little backlog of material to use. I will benefit greatly from this in that I will be able to send papers that need translation back and forth to their authors until they are perfect. Hopefully this will result in fewer errors getting published. We will be keeping the "Breeders Forum" as long as there is reader input. Also, we will continue to offer free space to members who wish to advertise.

The featured frog of this edition is *Dendrobates tinctorius*. Once again we have a paper outlining some husbandry tips from the prolific pen of Erik Wevers. Many thanks to Mr. Wevers for his unfailing enthusiasm for "Gifkickers" and for his willingness to share his knowledge and experience with us. We also have a fine paper by Jonathan Ertelt, of The National Aquarium in Baltimore, giving some much needed horticultural advice. There are reports by both the ISSD Secretary/Treasurer and the ISSD President. Please pay close attention to these because they outline the directions that our society will take as we head into our second year. Both of these gentlemen have expressed a desire to hear from any member who wishes to express opinions concerning any aspect of societal function. Last but not least, we have an interesting report by Bill Perreira detailing his observations on some rather startling differences in the coloration of some same-clutch, captive bred/captive raised, *D. tinctorius* raised under different conditions.

SOME PLANTS PROVEN USEFUL IN DENDROBATID HUSBANDRY

by Jonathan Ertelt, Horticulturist
National Aquarium in Baltimore

During the past year I have had the pleasure of working with herpetologists Jack Cover and Anthony Wisnieski at the National Aquarium in Baltimore setting up exhibition and breeding terraria for the large collection of frogs, predominately dendrobatid, maintained at the Aquarium. I was acquainted with these frogs as a passionate observer on two plant collecting trips in the mountainous forests of Panama, having there observed *Dendrobates auratus* and *D. speciosus* as well as several other groups. As a horticulturist, I have worked on the creation of simulated tropical environments and am well versed in tropical plants, especially neotropical plants. My interest in the various groups of frogs combined with my knowledge of neotropical plants and habitats have been valuable assets in helping set up terraria for display and for back up breeding tanks.

Bromeliads, members of the pineapple family, have proven beneficial, especially in providing habitats for those species which feed their tadpoles with food eggs. *Dendrobates pumilio* and *D. speciosus* have both utilized the bromeliads in their terraria at the Aquarium. In fact, both of these species have laid eggs and subsequently transported the tadpoles to bromeliad plants. After depositing the tadpoles in the small pools of water formed by the leaves of the bromeliads, the frogs have fed the developing tadpoles with infertile eggs. Similar behavior has been observed with *Dendrobates histrionicus*, utilizing a specific bromeliad, *Vriesea splendens*, as reported in 1981 by Helmut and Elke Zimmermann (Sozialverhalten, Fortpflanzungsverhalten und Zucht der Farberfrosche *Dendrobates histrionicus* und *D. lehmanni* sowie einiger anderer Dendrobatiden, Zeitschrift Des Kolner Zoo, 24, pp. 83-99). The food-egg fed

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tadpoles appear to be developing much more quickly than others of the same species which were harvested from the rearing tank and fed egg yolk by the Aquarium staff. *Dendrobates auratus* and *D. reticulatus* have also utilized bromeliads, however both of these species have simply laid eggs on the upper surface of the leaves and have not been seen to provide the same type of parental care as is the case with the two species mentioned above.

Bromeliads are quite diverse in size, shape, presence or absence of leaf edge spines, and environmental adaptability. All these factors are important when considering their usefulness in breeding and display terraria. The genera *Guzmania* and *Vriesea* both have characteristics which are favorable when considered in light of these criteria. Neither genus tends to have sharp or spiny leaf edges. This is much more important than one might first think. Dendrobatids have delicate skin, easily damaged as they crawl about on the plants. This point was unfortunately illustrated at the Aquarium when a gravid specimen of *Phyllobates bicolor* was discovered, having been split open by the leaves of a plant of another genus of the bromeliad family. The rosettes of leaves of the majority of species and hybrids of these two genera flatten out providing good areas for sitting and from which to announce and defend territory. Both genera contain species and hybrids of diverse sizes, from mature plants suitable to twenty gallon terraria on up to four-foot and larger diameter plants better suited to walk-in exhibits. While *Vrieseas* generally prefer high light levels, many *Guzmanias* can tolerate lower light; several species being found as understory epiphytes.

One aspect of terrarium culture to which few, if any, bromeliads can adapt, is substrate sogginess. Although they may always have water standing in their vase-like leaf rosettes, constant moisture around the outer base of the plant, either from wet soil or moss, will almost always result in the plant base rotting, leading to the need for replacement. This can be avoided by planting them epiphytically (as they occur in nature) by mounting them on a tree branch. If they are simply planted in the substrate in a small terrarium, the results can be disastrous, especially if the plant contains developing tadpoles when it rots.

A satisfactory solution with respect to the long term health of the plant is mounting it, even when the plant is to be at ground level. Generally we use small slabs of cork bark, wiring the base of the plant to the bark with either coated wire or monofilament nylon. *Osmunda* fiber can be placed around the

base of the plant where it will provide some well aerated moisture. This helps encourage continued root growth, the new roots helping to further anchor the plant to the bark slab. The bark holds the plant away from the constantly saturated soil surface.

While bromeliads provide a natural habitat for several of the dendrobatid species, as well as water, cover, and perching locations for other species, they are by no means the only useful plants for dendrobatid husbandry. The Aroid family, *Araceae*, contains many members from both the new and old world tropics which are suitable for use in terraria. Much of the European literature on dendrobatid husbandry refers to *Scindapsus* as a valuable plant. Known also as Pothos, Devil's Ivy, and Variegated Philodendron, the plant is botanically *Epipremnum aureum*. Although in nature the leaves do get quite large, averaging over twelve inches wide and eighteen inches long, this vining plant adapts readily to low light levels and will ramble throughout the terrarium, rooting into moist air if no soil or moss is nearby. In this situation the leaves remain modest (approximately three inches wide by five inches long). They are sturdy enough to support all but the largest dendrobatids. Although used primarily for cover, we have often found egg masses on these leaves, particularly with *Phyllobates vittatus* and *P. lugubris*.

Other members of the aroid family are equally valuable, especially when a variety of material is desired for an aesthetically pleasing display. If the exhibit is large enough to include a branch or two for epiphytes, the genus *Anthurium* contains epiphytes in many different sizes. Many of these plants have showy flowers, fruit, or leaves. The leaves are generally sturdy and can provide hiding and/or perching areas. Not all Anthuriums will readily adapt to lower light levels, but they do not necessarily require high light either. Certainly as a genus, they are worth exploring.

Philodendron is a well known genus; it is best known for the small heart-shape leaved houseplant *Philodendron oxycardium*. Like *Epipremnum aureum* mentioned above, in nature this philodendron and many others in this genus can get to be quite large. Various species and hybrids can be maintained at a smaller size and are useful in terraria, especially if a varied and aesthetically pleasing display is desired.

Though not the last genus in this family with potential, *Spathiphyllum* should certainly be mentioned. This genus contains species of various sizes

and generally does quite well in moderate to low light levels. They have a more tolerant nature towards having wet roots, and provide good cover as well as an abundance of leaf surface area for eggs. Although the leaves are generally not sturdy enough to support the medium sized and larger frogs, the smaller Dendrobatids can use these leaves for sitting on or hiding underneath. *Dendrobates reticulatus* has used overlapping *Spathiphyllum* leaves as a deposition site for its eggs.

According to the observations of the Aquarium's herpetologists, the overlapping leaves just mentioned seem to be preferred. Egg masses are often seen on leaves which have overhanging leaves from the same or different plants, indicating that "protected" leaves are more desirable. Many of the plants mentioned grow in a way that produces such hidden, or protected areas. Increasing the density of foliage by placing several plants close together will provide similar protected leaf configurations.

The *Marantaceae*, or Arrowroot family, should also be mentioned as valuable perching and cover plants. *Phylllobates vittatus* have regularly deposited eggs on *Maranta leuconeura*, the commonly grown "Prayer Plant". We have recently seen eggs from *Epipedobates tricolor* on a leaf of *Maranta leuconeura* var. *erythroneura*, the red-veined prayer plant. The genera *Maranta* and *Calathea* offer colorful-leaved plants in a variety of shapes and sizes. The majority of these are tolerant of wet (though not stagnant) conditions, and medium light levels.

Two of my favorite families, *Begoniaceae* and *Gesneriaceae*, the latter more commonly known as the African Violet Family have purposefully not been mentioned. Although many begonias and gesneriads are commercially available and quite popular, they tend to be intolerant of the constantly moist conditions maintained in dendrobatid terraria. They also do not adapt well to the lower light levels often associated with slightly overgrown terraria. There are exceptions, some of which are quite beautiful. They are however more difficult to find commercially and offer no particular advantage other than botanical diversity.

To summarize; there are three main aspects of these plants which have proven valuable: 1.) They are found, or are similar to plants found where these frogs exist in nature. 2.) They are useful to the frogs for a variety of their natural activities. 3.) They offer a wide variety botanically, and are generally adaptable

to the conditions sought in breeding and exhibition terraria.

During the last year we at the National Aquarium in Baltimore have been successful in breeding quite a few different dendrobatid species: *Dendrobates reticulatus*, *D. auratus*, *D. pumilio*, *D. speciosus*, *D. azureus*, *Epipedobates tricolor*, *E. espinosai*, *E. anthonyi*, *Phyllobates vittatus*, *P. bicolor*, and *P. lugubris*. There are many factors that help account for these successes including higher humidity and in some cases cooler temperatures. The plant material cannot be given all the credit by any means but they do play a significant part! I hope that some of the information mentioned in this article will help others in their efforts to exhibit and breed the other jewels of the forest, the dendrobatids.



logo of The National Aquarium in Baltimore

ISSD Financial Update

One of the difficult problems that faced us as we planned the initial organization of **ISSD** was that of financial outlay projection and related income planning. There were many variables which were difficult to predict.

We had rough estimates of projected publishing expenses which in retrospect turned out to be fairly accurate. One area in which we underestimated our expenses was that of postage for the mailing of the newsletters. The greatest factor affecting this expense is the number of members not living in the U.S.. Postage for the newsletter averages \$.37 to \$.50 each for those newsletters mailed to members living in the U.S.. The cost of mailing the newsletters to Europe and South America ranges from about \$1.35

to \$1.75 each. We do not have enough pieces to qualify for bulk mailing rates and we have chosen first class over third class mailing, even though the expense is greater, because the service is much better.

In 1988 our income roughly matched our expenses. If the income does not increase in 1989 this will not be the case again. There are several reasons for this. Firstly, publication costs are going to increase. At the present time we are using a photocopy printing process. This is less expensive but it has great limitations. We would like to begin to put photographs in the newsletter. When we do this, there will be expenses involved in the production of half-tones for black and white photos. Also, it is likely that the quality of the reproductions will be inadequate unless we switch to offset printing (a more expensive process). At this time we do not know if it will be possible to print color photos. Even though it is highly desirable to have color photos, it is a very expensive proposition. In order to be able to print photographs, either black and white or color, we will have to use a different type of paper than we have been using. Once again the expense will be greater. Another reason our expenses will be going up is that the proportion of the membership living outside the U.S. is increasing, and with it our postage costs. We had some extra income in 1988 from the sale of back issues of the newsletter. New members joining after the publication of two or three newsletters often wished to start with the entire set and therefore purchased the back-issues. We anticipate that this will be less of a source of income in 1989.

One variable which affects both expenses and income is the size of the membership. At the time of this printing there are roughly one hundred and twenty members. This is better than we anticipated. When a new membership year starts, in any organization, there are some people who choose not to continue. We have no way of predicting how many will drop, but at this point in time we are expecting about a 10% loss. Hopefully this will be offset by new memberships.

Now we are faced with the task of planning for next year. Dues are being raised for the reasons discussed above. In 1989 there will be a differential in the fee to reflect the higher cost of postage to Europe and South America. We view the postage expense as just one part of our total operating budget, which is shared by all members. However we feel that it is equitable to ask those members who require the greater postage to pay for some, but not all, of the

increased expense. It is foreseeable that the Editorship of the newsletter may shift to some other member in 1990, perhaps a European, in which case the differential will be reversed. The 1989 dues will be as follows: For members living in the U.S.A. and Canada the fee is \$20.00 (U.S.); For members living in Europe and South America the fee is \$25.00 (U.S.).

Many of the memberships will need renewal after this edition. It is important that all those who are up for renewal, send in their dues as soon as possible after this edition. If not, we may have trouble putting out the first few editions of Volume II. On the back cover of this edition there is a check box with the following message next to it: **IF THIS BOX IS CHECKED - YOUR 1989 MEMBERSHIP FEE IS DUE.** Please be sure to look at the back cover to see if you are one of the lucky ones. Also, as you renew your membership, please update us concerning address changes. Some of the names on the membership roster did not have telephone numbers listed. If you would like your telephone number to appear on the list please furnish it to us, along with a note calling our attention to the fact that it was not previously listed and you wish it to be listed now. We would appreciate it greatly if all correspondence with us could be typed or at the very least, printed very clearly so that there are no errors. Because we are on a tight budget, there will be no grace period. If your fee is due and you do not send it in, you will not get the next newsletter.

We have had a significant problem with checks from European banks. If we receive a check from a Non-U.S. bank there are fees extracted during the processing of that check. The loss is greatest with a check that comes from a Non-U.S. bank but which is made out in U.S. dollars. As an example, we recently received a check from a German bank for \$16.00. Because this check as not in the currency of the bank from which it was issued, it had to be "sent for collection". Our bank charged us a fee for this, in addition the German bank also charged a fee. Our bank then received payment in Deutsche Marks, which had to be exchanged to U.S. dollars. We were charged an exchange fee. The whole process took seven weeks and from a check originally made out for \$16.00, we actually received only \$6.00. I am sure that our members would prefer that their money went to support ISSD rather than the banks! **SO**, we are asking that in the future, payment be made in one of the following ways (listed in order of preference): 1.) A Cashier's check from a U.S. bank made out in U.S. dollars. 2.) A U.S. Postal Money Order made out in U.S. dollars. 3.) Cash

-U.S. dollars, wrapped well so that it cannot be seen through the envelope and sent via registered mail. 4.) Cashier's check from a Non-U.S. bank made out in the currency of the bank of issue for an amount which will yield \$28.00 U.S. when it is exchanged.

We are pleased with the financial status of **ISSD** after its first year (we are not in the red!). We look forward to another good year and hope that as time passes the Society will continue to evolve in a positive direction.

Submitted by:

Ed Tunstall,
ISSD Secretary/Treasurer

A MESSAGE FROM THE PRESIDENT

ISSD is nearly one year old. We have come a long way in 1988, implementing our Constitution and Bylaws and stating our goals and objectives for the future. We are a maturing organization, but there is much to be done. Our current success has been due, for the most part, to the efforts of one man, Dale Bertram. Seldom have I seen an individual as enthusiastic and determined. With the help of a few individuals, he has brought his concept to fruition. We have a healthy society, and now it is up to us to keep it that way. As often the case with specialized or regional groups, they can rise or fall on the degree of dedication of one or two individuals.

We need the support of **all** our members to help answer inquiries and to submit material for publication. We are also asking for your support in the effort to develop a database concerning what species are being kept in captivity,

by whom, and with what degree of breeding success. Centralization of this information is paramount to a successful "gene pool maintenance" program, one of the stated goals of **ISSD**. Sometime in 1989 we will be sending out a questionnaire with one of the newsletters. Data compiled from your responses will be used to formulate the "breeders registry". It is our hope that you will not only submit the data, but also that you will begin to use the registry as a tool to keep your collections genetically diverse and healthy.

We have published six numbers of Volume I of the **ISSD** Newsletter, on time. This can be said for very few self supporting armature or professional societies. The backbone of an international organization like **ISSD** is its publication. This is the only forum the vast majority of our members can use to communicate their ideas; lets use it! I would like to see the bulk of the administrative duties fall to the Board of Directors, where it belongs. This would free Dr. Bertram for the task of publishing the Newsletter where he excels. Ed Tunstall has done a great job writing the constitution, computerizing the membership roster, and managing the finances during our first year. He has flagged a potential problem for 1989, a shortage of funds. With membership at just over 120, and limited growth potential, it consumes nearly all our resources just to publish the newsletter. Because of the international nature of our membership it is not feasible to mail our newsletter at bulk rate, or even third class. If we were to do this it is conceivable that many of the newsletters might never reach their destination. I therefore support Ed's proposal to increase dues to \$20.00 USA and \$25.00 overseas in 1989. This should keep us financially solvent for the foreseeable future.

Our first annual meeting, in conjunction with the International Herpetological Symposium, was productive for both **ISSD** and **IHS**. It seems like a logical forum for future business meetings and workshops. I would like to hold our second annual meeting during the 13th **IHS** in Phoenix, Arizona, starting June 20th, 1989. Please make every effort to attend.

As we enter our second year of operation we welcome your support. Please make every effort to promote **ISSD**, and to solicit new members from among your colleagues. Take an active role in the Newsletter, and do not

hesitate to contact me or any other board member with your ideas, comments, and willingness to be of service.

Dave Hulmes
President, ISSD

Dendrobates tinctorius

by Erik Wevers

The *Dendrobates tinctorius* group enjoys widespread popularity here in Holland, as well as in Germany and Belgium, because of their beautiful colours and the fact that they are not timid around humans. Often they will, upon seeing the keeper, come forward in expectation of a feeding. This behavior makes them easy to view and enjoy.

Dendrobates tinctorius can be found in Guyana, Surinam, French Guyana, and parts of northern Brazil. There are many different colour forms of *tinctorius*. For example, one of the smallest (about 3.5 cm SVL) and most attractive is the "white form", which comes from French Guyana. One of the largest colour forms (5 - 6 cm SVL) is the "grey form, which comes from the De Haan mountains of Surinam. Recently a new form has been found in French Guyana which is nearly 8 cm SVL, these are black and yellow. They have been referred to as the "Giant Dendrobatids".

In Holland we have had *D. tinctorius* for many many years. The most common specimens are those which are found in the Ta Fel mountains of Surinam. They are black with cobalt blue legs and ventral surface, they have yellow on the heads and back. They average about 4.5 - 5 cm SVL.

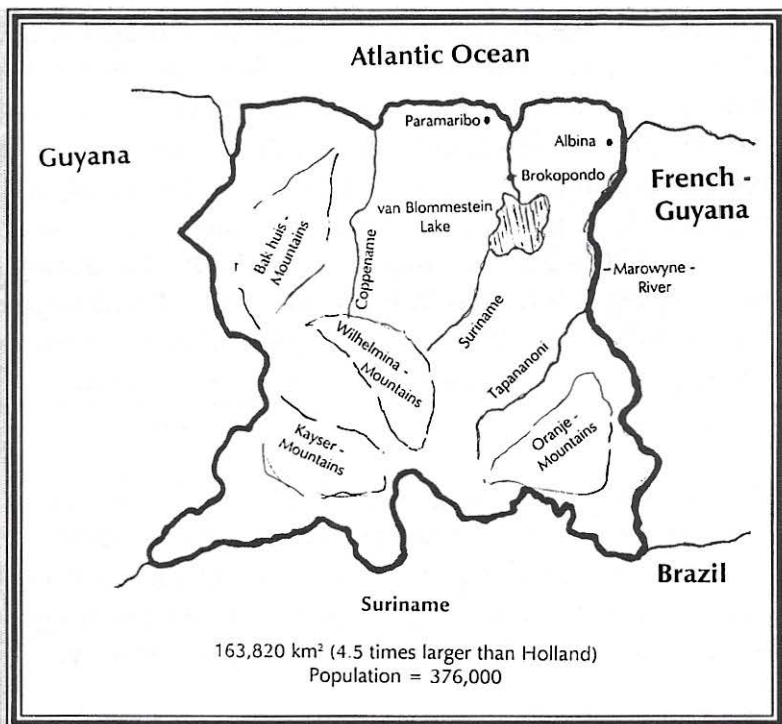
(C) Copyright 1988, Erik Wevers

Females of *D. tinctorius* are always bigger than males and the males have noticeably wider toepads on the front feet. The females tend to be quite aggressive towards each other and one should not try to keep too many of them together in one terrarium. This species is a large one and the frogs are very active; they need a very large enclosure. They are fond of sitting in water and therefore a water dish is a must in their terrarium. The temperature should be kept quite high, about 26° - 28° C by day and about 20° - 22° during the night. *D. tinctorius* is a very big eater, therefore you must feed them large quantities of food. This is especially true of the growing froglets. If they are not fed enough as they are growing they will mature small and will never grow larger. In this respect, *D. tinctorius* is like *D. azureus* and *D. silverstoni*.

D. tinctorius is not difficult to breed; if you have not found this to be true then the most likely reason is that the pairs you have are not "loving" each other enough. You must break up the pairs and pair individuals with other frogs. Temperature is also a factor in breeding, keeping them too cool may be another cause of breeding failure. Similarly, they require high humidity.

When they are ready to breed, the female pursues the male until he responds. A breeding male will advertize his willingness by calling. The call is a very faint and low pitched "buzz" call, similar to that of *D. azureus*. It is the male who seeks out the egg laying spot. Clutches range from five to fifteen eggs. The eggs are tended by the males, and after about sixteen to eighteen days the eggs hatch. If left in the terrarium, the eggs will be transported to water by the male. They can also be harvested and raised artificially in the same manner as *D. azureus* tadpoles. The tadpoles cannot be raised together with each other. It takes about three months to get small froglets and after about one to one and a half years the froglets will be full grown and laying their own eggs. So you see with a little luck and good husbandry techniques, you can enjoy your *tinctorius* for many many years. Concerning the life span of dart-frogs; At the present time I have one eighteen year old *P. vittatus*, a fourteen year old *D. leucomelas*, and a ten year old *D. tinctorius* (Ta Fel Mountain). Last year I suffered the loss of a ten year old *D. azureus*.

The following is a list of some of the known color forms of *D. tinctorius*:



Tafel Mountain

Bakhuis Mountain (two forms)

Kayser Mountain

White tinctorius (also two forms)

French Guyana (yellow and black)

French Guyana (Giant yellow and black)

French Guyana (black)

Grey form

Black with white punts

Brazil form

Editor's note: the word "punts" used above is, no doubt, not the correct English word for what Mr. Wevers is trying to communicate. I regret that there was not enough time to clarify the translation of this word from the Dutch before this went to press. Responsibility for this error rests with the editor.

HOW MUCH DO ENVIRONMENTAL FACTORS INFLUENCE COLORATION IN *Dendrobates tinctorius*?

a short essay by Bill Perreira

During August of last year (1987) Dale Bertram purchased eight juvenile *Dendrobates tinctorius* from the Oklahoma City Zoo. Shortly after he received them he sent four of them to me. These frogs were all same-clutch sibling captive bred offspring (F₁) of the cobalt-blue color phase. Four of the specimens (3:1) were raised by Dale in Madison, Wisconsin and the other four (1:2:1) were raised by me in Honolulu, Hawaii.

The Wisconsin frogs were raised in a 50 breeder aquarium converted to a terrarium with the following controlled climatic conditions: Daytime temperature approximately 82° F, nighttime temperature approximately 76° F; light was provided by two 40 watt Vitalites, suspended approximately 70 cm above the substrate, and left on for fourteen hours per day; forced air ventilation was provided through a screen mesh top (sufficient breeze to stir the plants); and relative humidity was static at approximately 80-90%. Diet consisted of vitamin dusted pinhead crickets with an occasional supplementation of flightless mutant *Drosophila melanogaster*.

My frogs, raised in Honolulu, were kept in a 20 gallon (60 x 30 x 45 cm - LxDxH) screen covered terrarium illuminated by 50 watts of incandescent light suspended approximately 45 cm above the substrate for twelve hours per day. An estimated relative humidity of 70 -90% was achieved by daily misting. The room in which the frogs were kept is open to the outside air and temperature has ranged from 65° - 85° F over the past year. This group was fed mainly with vitamin dusted worker caste termites of the genera *Kaloterme*s and *Neoterme*s. This was periodically augmented with *Pheidole megacephala* ants and *Drosophila silvestris* flies.

Dale visited me in Honolulu just recently (early November) and he brought some of his frogs with him with the idea that we could both improve the sex ratios of our respective colonies by trading specimens. Striking

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differences between the Madison frogs and the Honolulu frogs, with respect to coloration, and to a lesser extent size, were immediately apparent when comparing the specimens.

Honolulu raised specimens were about 10% smaller, on the average, than the Madison frogs. We assume that all individuals were fully grown since they all seem to be "large" and growth has been static for some time now. Also, males of both groups have been observed calling and all females appear gravid. One Madison female has produced 112 eggs over the last three months.

We found little difference in the cobalt-blue coloration of the legs and venter. A uniform blue pattern is reticulated with black on all four legs, the blue on the abdomen is somewhat lighter, approaching sky-blue in some areas. Over all, the blue of the Madison specimens is somewhat lighter. However the blue can vary considerably on any one individual at different times, being influenced by such factors as time of day, stress, and temperature. The enlarged digital discs of the forelimbs of males of both groups is a light azure blue.

Spots and blotches of black in a field of yellowish-white are seen on the

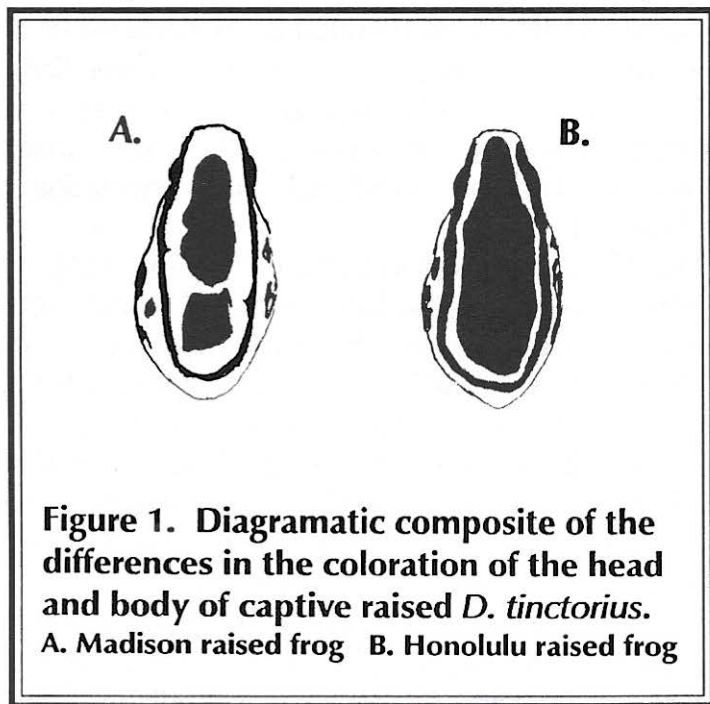


Figure 1. Diagrammatic composite of the differences in the coloration of the head and body of captive raised *D. tinctorius*.
A. Madison raised frog B. Honolulu raised frog

lateral portions of the abdomen in both groups. This black coalesces to a single unbroken black stripe that originates at the nares, travels through the eyes laterally and extends caudad at the lateral margins of the dorsum, eventually meeting above the pelvis to form a black ring. This ring completely encloses the lateral margins of the dorsum. Immediately adjacent to this black ring, the skin of the dorsum is yellow. On the Honolulu

specimens this black ring is up to one and one-half times wider, as can be seen in figure 1. Black skin also occurs on the median portion of the dorsum. The black coloration is more extensive on the Honolulu specimens; a single ovoid blotch originates just in front of the eyes and extends down the back, ending midway along the pelvic girdle. On the Madison raised frogs the black begins behind the eyes and is usually broken mid-dorsally by a yellow crossbar creating two or more large ovoids before ending halfway along the pelvis. Paired yellow dorsolateral stripes separate the black ovoids from the aforementioned black ring. The yellow stripes are wider, more brilliantly yellow and more irregular on the Madison frogs (figure 1A).

So why are the frogs which were raised in Wisconsin larger and more brightly colored? Diet, environmental conditions, stress factors, and light exposure may all effect coloration to varying degrees. In those species of *Dendrobates* and *Phyllobates* which have been studied it is known that individuals which are captive bred or have been field collected but maintained in captivity for long periods of time may dim in color. In the more toxic species it has also been observed that toxicity diminishes with length of time in captivity. Mr. Charles Nishihira, a Honolulu resident and ISSD member, recently returned from a collecting expedition to South America with some interesting observations germane to this discussion. While collecting *Epipedobates bassleri* (formerly *Dendrobates bassleri*) in Peru, Charles noted that the colors of *bassleri* which inhabit open areas exposed to much sunshine (e.g. forest clearings) were much brighter and more iridescent than those which inhabited closed forest areas. Both morphs could be found within meters of each other in places where disturbed forest abutted undisturbed forest. Could it also be possible that the more subdued lighting is the primary factor affecting the development of the duller and more melanistic Honolulu raised *tinctorius*?

At this time it is difficult to evaluate the relative importance of the variables identified in this case. More quantitative data are needed to elucidate this phenomenon. Same-clutch siblings, as with our two *tinctorius* groups, seem ideally suited to help clarify this intriguing question. I do not suggest that sibling groups need to be broken up and sent off to far away places for the studies to be valid. In fact such studies, if conducted at one site, could be more easily designed to isolate single variables.

"The Breeders Forum"

Phyllis Williams of Bothell, Washington submits the following: " three *vittatus* of mine developed brown, slimy patches on their legs. Two of the frogs died shortly after I noticed the problem. Examination of the third frog showed that the leg was actually rotting. This one died a few days later despite treatment with tetracycline. A year later the same problem came to my *tinctorius*. I cleaned the water dish and put in one-quarter of a tablet of tetracycline. I repeated this treatment every day for a week and all the frogs survived. I believe that the problem was bacterial, and that it began in the dirty water dishes. Now I change the water daily and I have not had a recurrence since". Mrs. Williams would like to know if others have had similar experiences and if so, how they have dealt with it. Mrs. Williams also writes: "None of my *leucomelas* larvae have hatched out of the gelatine on their own. A local herp breeder told me that this is common but he did not tell me why it happens or what to do about it. I recently cut the gelatine away from two larvae that were late hatching. I am hoping that someone can give me some advice on this".

Mr. Greg Suchanyc of Piermont, New York writes to us concerning the problem of how to best heat the single-tank vivarium. "In setting up the tank, I first put in a layer of coarse gravel about three or four inches thick. I then bank up the gravel on both sides of the tank, creating a ditch or gully in the middle of the tank, which runs from the front to the back. To reinforce the gully I put flat rocks against the gravel banks. The gravel is then covered with peat moss in a layer two to four inches thick. Water is put into the terrarium so that it fills the gully and rises about an inch into the peat. The small pond area is heated with a submersible aquarium heater and filtered with a flat sponge type aquarium filter. I usually heat the water in the pond to about 85° F. The heat generated by the heater not only heats the pond but keeps the saturated substrate warm as well. To finish the self contained vivarium a layer of live sphagnum moss (approximately one inch thick) is placed on top of the peat. This will grow well in the very warm and humid environment. The tank is then decorated with branches and live plants".

Reader responses to these two entries are encouraged, as are new questions for the "Breeders Forum".

Classified Ads:

Unusual opportunity to acquire a color morph of *D. histrionicus* rarely seen! Wild caught adults, 1 - 1&1/4 inches, black legs, small red blotches that tend to coalesce over the black back and ventral surface. Have been held by me for about five weeks, stabilized, fed, wormed, and the weak ones culled out. Better risk with these delicate frogs than if they were purchased direct from the importer.

\$20.00 each plus shipping (airfreight a must). Call Dale Bertram at 608-233-1083.

SALE: I never thought that I would have too many Dart-Frogs, but I do! Stock reduction sale: *D. auratus*, CB - Hawaiian. In groups of 8 for \$60.00, plus express mail postage with winter pack (\$20.00). Call Dale Bertram (608-233-1083).